

NEW GENUS *LIAOXIENTULUS* (PROTURA, ACERENTOMIDAE) FROM NORTHEAST CHINA

WU Dong-Hui^{1,2}, YIN Wen-Ying³

1. Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, Changchun 130012, China; E-mail: wudhyang@yahoo.com.cn

2. College of Earth Science, Jilin University, Changchun 130012, China

3. Institute of Plant Physiology & Ecology, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences, Shanghai 200032, China

Abstract *Liaoxientulus* gen. nov. is created to accommodate *Liaoxientulus xingchengensis* sp. nov. and one undetermined *Liaoxientulus* sp., found from Northeastern China. The new genus belongs to the subfamily Tuxenentulinae Yin, 1983 of the family Acerentomidae. The new genus is close to *Yichumentulus* Yin, 1980, also known from Northeast China. *Liaoxientulus* differs from *Yichumentulus* in the structure of the reduced labial palp, and the presence of sensilla *b'* on foretarsus. The labial palp in *Yichumentulus* has four setae and one large sensilla; but only with three setae in the present genus, and the sensilla is absent.

Key words Protura, Acerentomidae, *Liaoxientulus*, new genus, new species, Northeast China.

1 Introduction

In Aug. and Sep. 2006, two interesting acerentomids were found in Xingcheng City, Liaoning Province, Northeast China. In contradistinction to all the other known genera of Acerentomidae (Imadaté, 1974, 1978, 1986; Nosek, 1973a, 1973b, 1980; Szeptycki & Weiner, 1997; Szeptycki & Christian 2001; Szeptycki & Bedano, 2003; Tuxen, 1963, 1976; Yin, 1980, 1999), it is very similar to *Yichumentulus* Yin (1980) in many respects, but differs in the structure of the reduced labial palp and in the presence of sensilla *b'* on the foretarsus. This proved that the fundamental characters of the interesting acerentomidae warranted recognition of a new genus as given in the following lines.

2 Abbreviations

The abbreviations used in the present paper are according to Imadaté's system (Imadaté, 1974; Wu & Yin, 2008).

3 Taxonomy

Liaoxientulus gen. nov.

Type species. *Liaoxientulus xingchengensis* sp. nov., by original designation.

Diagnosis. The new genus belongs to the subfamily Tuxenentulinae Yin, 1983 of the family Acerentomidae, on the basis of having four setae on abdominal appendages I, and each two setae on abdominal appendages II and III; calyx of filamentum di sostegno ovoid, smooth; urosternite VIII with four anterior setae and two posterior setae. Head with postpseudocular seta; two pairs of anterior setae (A2

and A4) on mesonotum and metanotum; seta P2a on meso- and metanotum nearer to P3 than to P2; seta P3 on urotergites II – VI anterior to line P2 – P4; striate band on abdomen VIII present; telson with a dorsal central pore and a pair of ventral pores at both sides; the presence of sensilla *b'* on foretarsus; the labial palp in the present genus has only three setae, and the sensilla is absent.

Description. Head without differentiated sensory setae. Postpseudocular seta present. Labial palpus reduced, with three setae and no sensilla. Canal of maxillary gland simple, with smooth, ovate calyx and long, simple posterior filament. Pseudoculus nearly round.

Foretarsus with all sensillae; dorsal sensilla *t*-1 claviform; *t*-2 thin and pointed; *t*-3 shape of broad jar; exterior sensilla *c* and *d* close to each other; *f* distinctly nearer to *e* than to *g*; interior sensilla *a'* slightly proximal to *t*-1; *b'* present, at about the same row as δ 3; ventral seta β 1 and interior seta δ 4 both short and sensilla-like. Pores present between *a* and α 3, and between *t*-3 and *g*, respectively.

Thoracic tergite II – III each with two pair of dorsal anterior setae, A2 and A4; seta P2a on meso- and metanotum nearer to P3 than to P2. On urotergite II – VI, posterior principal setae P3 situated a little anterior to the others, all such accessory setae as *p*2a and 4a being very short, sensilla-like. Urosternites I – VII with 3 anterior setae, A_c and A2; VIII with 4 anterior and 2 posterior setae. Thoracic tergite II with two pairs of pores, of which one is posterior to A4 and the other posterior to P4, III with a pair of pores posterior to P2. Porotaxy formula of urotergites I –

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VII / 1 + 1/1 + 1/1 + 1/1 + 1/1 + 1/1 + 1/1 + 1/. Urotergite VIII with a pair of pores between *M2* and *M3* without pectinates. Telson with a dorsal central pore and a pair of ventral pores at both sides.

Abdominal appendages II and III each with two setae, the lateral apical one more than half as long as the subapical one in length. On abdomen VIII, striate band present, may be seen more or less distinctly.

Etymology. The genus name (female gender) is named after Liaoxi district in Northeast China where the type specimens were collected.

Remarks. *Liaoxientulus* gen. nov. belongs to a group characterized by a reduced labial palp and a modified striate band on abdomen VIII, may be seen more or less distinctly. The present new genus is close to *Yichumentulus* (1980), known from Northeast China, since it shares with *Yichumentulus* many fundamental characters such as the shape of sensilla *t1* on the foretarsus, the structure of canal of maxillary gland, the formula of setae on meso- and metanotum, the structure of striate band and the formula of setae on abdomen VIII, and *Liaoxientulus* differs from *Yichumentulus* in the structure of the reduced labial palp, and the presence of sensilla *b'* on foretarsus. The labial palp in *Yichumentulus* has four setae and one large sensilla; in *Liaoxientulus* it only with three setae, and the sensilla absent.

***Liaoxientulus xingchengensis* sp. nov.** (Figs 1 – 18)

Holotype female (No. EN-LN-06-08-11), from the hawthorn orchard of Diaoyutai Town (40°36'N, 120°47' E), Xingcheng City, Liaoning Province, China, collected in Aug. and Sep. 2006, by Dr. WU Dong-Hui. Paratypes 3 females (Nos. EN-LN-06-08-12, EN-LN-06-08-13 and EN-LN-06-08-14), same data as holotype. Holotype and one paratype are preserved in Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, two paratypes are preserved in Institute of Plant Physiology & Ecology, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences, China.

Diagnosis. Labial palps reduced, only with three setae. Pseudoculus almost circular, with two small lids. Sensilla *a'* on foretarsus thin and proximal to *t1*. Female squama genitalis with long pointed acrostyli. On abdomen VIII, striate band present, may be seen more or less distinctly.

Description. Holotype body length up to 900 μm .

Head 120 μm long in dorsal view, setae *a*, *ls* and *pp* present (Fig. 1). A median pore present. Rostum not protruded. Pseudoculus almost circular, with two small lids (Fig. 2), PR = 15. Canal of maxillary gland simple (Fig. 3), the proximal part 12 μm long with posterior dilation, bipartite, CF = 10. Maxillary palpus with two setae and no sensilla (Fig. 4). Labial

palpus reduced, only with three setae (Fig. 5).

Foretarsus (Figs 6 – 7) length 82 μm , claw 20 μm , without inner and outer flap, TR = 4.1. Empodium length 5 μm , EU = 0.25. S-shaped seta subequal to claw. Dorsal sensilla *t1* claviform, BS = 0.79; *t2* thin and setiform; *t3* leaf-like. Exterior sensilla *a* long, almost reaching the base of $\gamma 2$; *b* short, nearly reaching the base of $\gamma 3$; *c* almost reaching the base of *e*, *d* surpassing the base of *f*, *c* and *d* close to each other; *e* and *f* surpassing tarsus, *g* almost reaching tarsus, *f* distinctly nearer to *e* than to *g*, *e* and *f* longer than *g*. Interior sensilla *a'* thin and proximal to *t1*, reaching the base of *b'*; *b'* long, surpassing the base of *c'*; *c'* also long and thin, its apex surpassing tarsus. Ventral seta $\beta 1$ and interior seta $\delta 4$ both short and sensilla-like, $\beta 1$ subequal to $\delta 4$. Interior setae $\delta 1$, $\delta 2$, $\delta 3$ and $\delta 5$ each short, but longer than $\delta 4$, and apically pointed. Pores present between *a* and $\alpha 3$, and between *t3* and *g*, respectively. Middle tarsus length 40 μm , claw length 12 μm . Hind tarsus length 43 μm , claw length 13 μm .

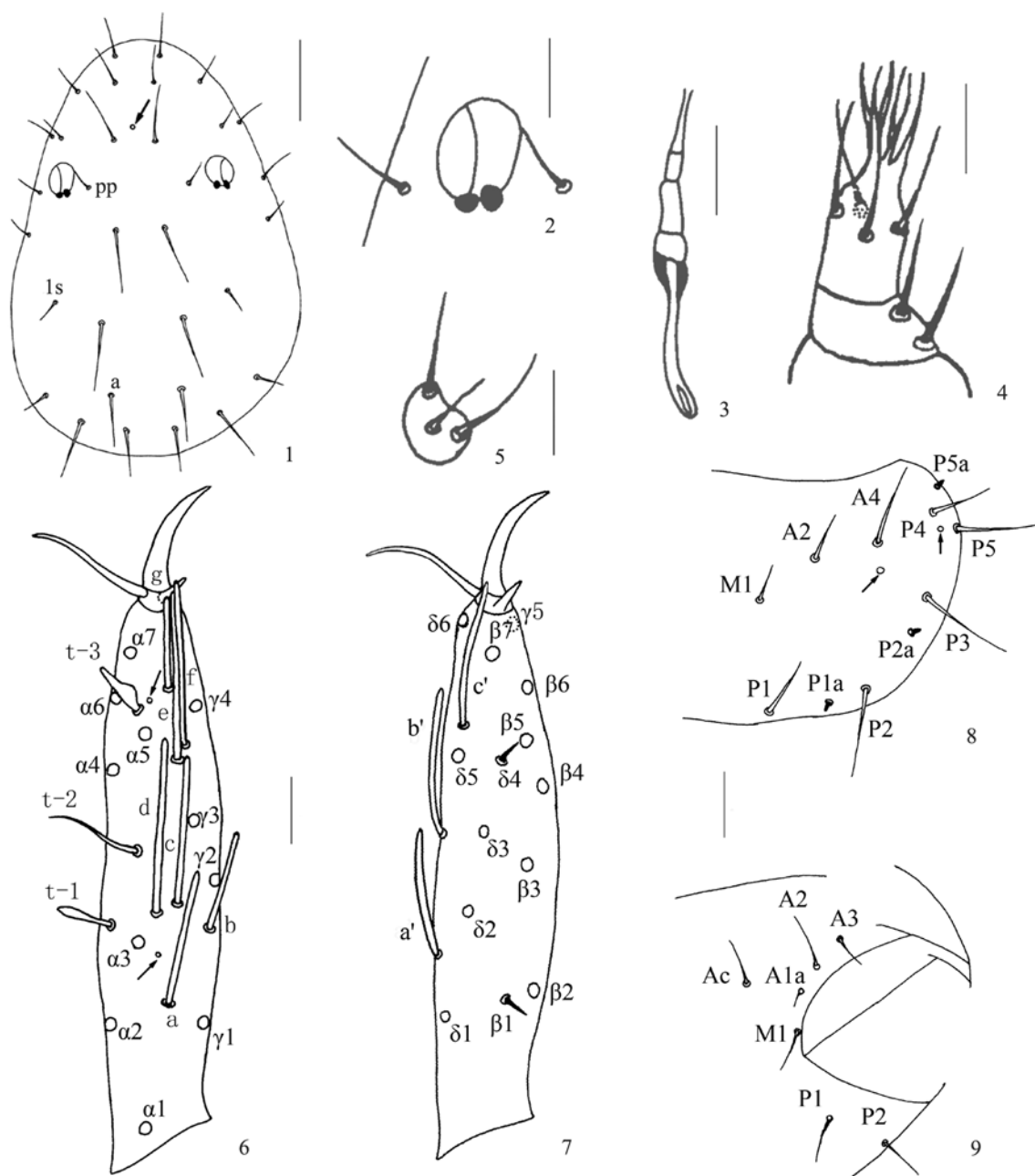
Body. Chaetotaxy as shown in Table 1 and Figs 8 – 15. Thoraces II – III each with two pair of dorsal anterior setae, *A2* and *A4*; seta *P2a* on meso- and metanotum nearer to *P3* than to *P2*. Urotergite I – VI each with three pairs of anterior setae, *A1*, *A2* and *A5*, *P1a* absent. Urotergite VII with 8 anterior setae, *A1*, *A2*, *A4* and *A5*; seta *P1a* present. Urotergite IX with 14 setae, X with 12 setae, XI with 6 setae, XII with 9 setae. Urosternites I – VII each with 3 anterior setae, *Ac* and *A2*; VIII with 4 anterior setae and 2 posterior setae; IX – X each with 4 setae; XI – XII each with 6 setae.

Integumental pores distinct (Figs 8, 10 – 15). Thoracic tergite II with two pairs of pores, of which one is posterior to *A4* and the other posterior to *P4*, III with a pair of pores posterior to *P2*. Abdominal tergites I – VI each with a pair of pores between *A2* and *P1*, VII with a pairs of pores anterior to *P1a*, VIII with a pair of pores between *M2* and *M3* without pectinates. Abdominal sternites IV – VI each with single pore anterior to one of *P1a*, VII with single pore anterior to one of *P1*. Telson with a dorsal central pore and a pair of ventral pores at both sides.

Abdominal appendages II and III each with two setae, the lateral apical one more than half as long as the subapical one in length (Fig. 16). On abdomen VIII, striate band present, may be seen more or less distinctly (Fig. 12), comb consisting about 8 teeth of irregular size (Fig. 17). Female squama genitalis with long pointed acrostyli (Fig. 18), male squama genitalis unknown.

Younger instars. Unknown.

Distribution. Liaoning Province, Northeastern China.



Figs 1–9. *Liaoxientulus xingchengensis* sp. nov. 1. Head, dorsal view. 2. Pseudoculus. 3. Canal of maxillary gland. 4. Maxillary palps. 5. Labium. 6. Foretarsus, exterior view. 7. Foretarsus, interior view. 8. Mesonotum. 9. Mesosternum. Arrows indicate pores. Scale bars: 1 = 22.5 μm , 2 = 7.5 μm , 3, 6–7 = 10 μm , 4 = 5 μm , 8–9 = 17.5 μm .

Etymology. The specific name refers to Xingcheng City where the new species were found.

Liaoxientulus sp. (Figs 19–36)

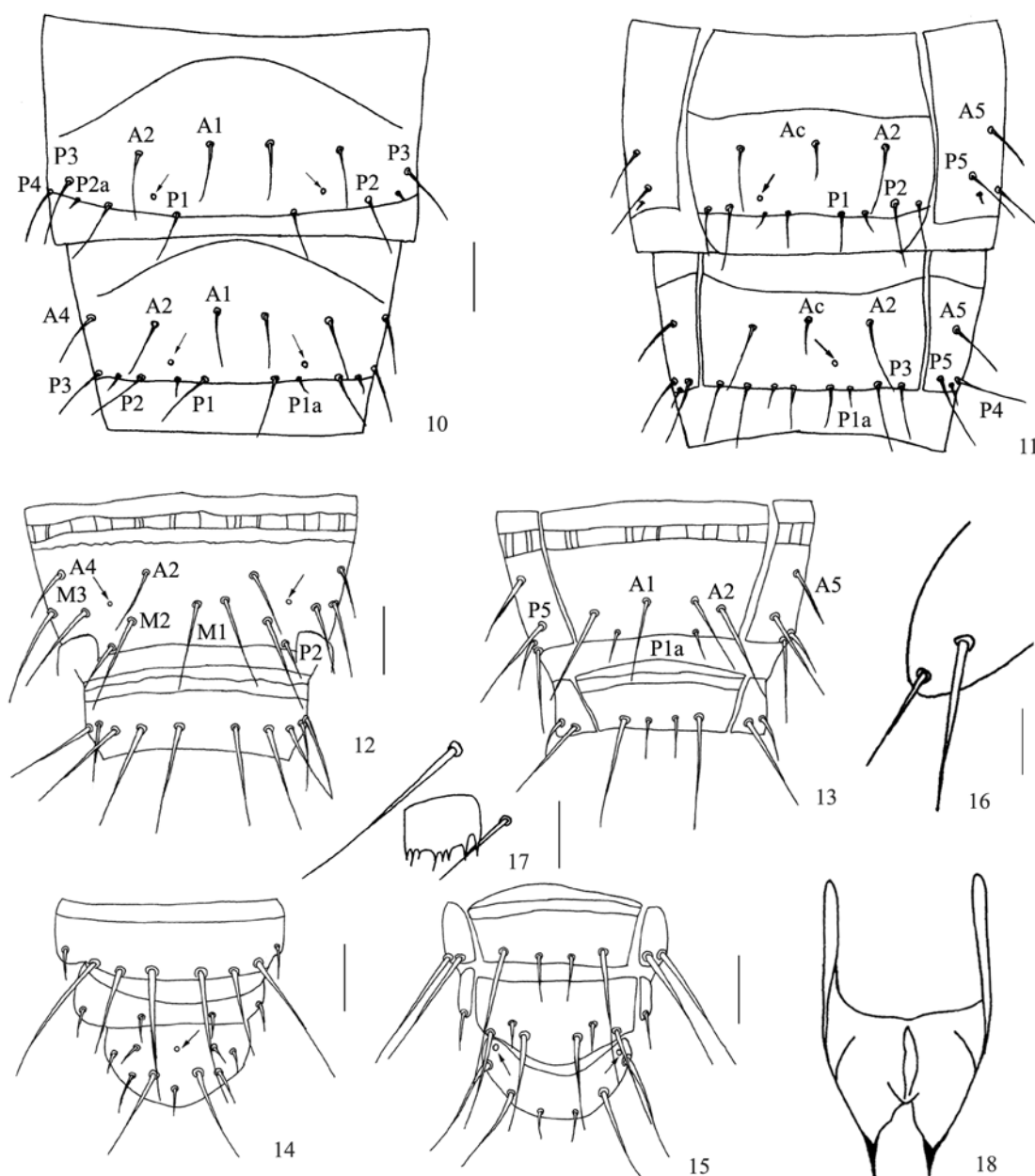
Type material. 1 female (No. EN-LN-06-08-21), from the hawthorn orchard of Diaoyutai Town (40°36'N, 120°47'E), Xingcheng City, Liaoning Province, China, collected by Dr. WU Dong-Hui. The specimen is preserved in Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, China.

Diagnosis. Labial palp reduced to three setae,

and sensilla absent. Pseudoculus almost circular, without any lids. Sensilla *a'* on foretarsus broad and proximal to *t*-1. Female squama genitalis with long pointed acrostyli, and short, thick, stump, strongly sclerotized basal apodemes. On abdomen VIII, striate band present, may be seen more or less distinctly.

Body length 1 210 μm .

Head. 125 μm long in dorsal view, setae *a*, *ls* and *pp* present (Fig. 19). A median pore present. Rostum not protruded. Pseudoculus nearly round, without lids (Fig. 20), PR = 12.5. Canal of maxillary gland



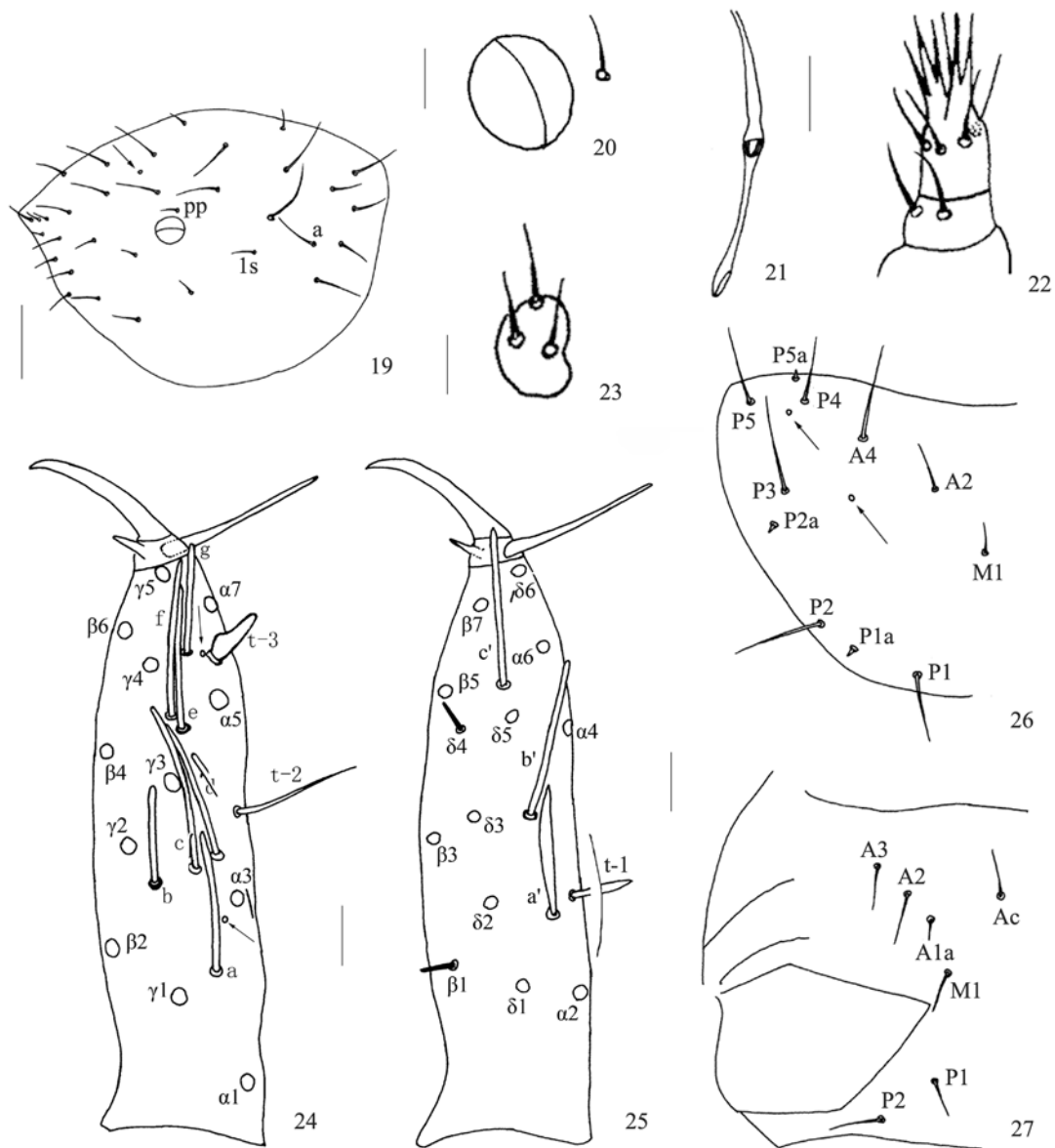
Figs 10 - 18. *Liaoxientulus xingchengensis* sp. nov. 10. Urotergites VI - VII. 11. Urosternites VI - VII. 12. Urotergites VIII - IX. 13. Urosternites VIII - IX. 14. Urotergites X - XII. 15. Urosternites X - XII. 16. Abdominal appendage II. 17. Comb on abdominal tergite VIII. 18. Female squama genitalis. Arrows indicate pores. Scale bars: 10 - 11 = 27.5 μm , 12 - 13 = 22.5 μm , 14 - 15 = 20 μm , 16 = 9 μm , 17 - 18 = 10 μm .

simple (Fig. 21), the proximal part 16 μm long, CF = 7.8. Maxillary palpus and labial palpus as in *X. liaoxiensis* (Figs 22 - 23).

Legs. Foretarsus (Figs 24 - 25) length 87.5 μm , claw 25 μm , without inner and outer flap, TR = 3.5. Empodium length 7 μm , EU = 0.28. S-shaped seta subequal to claw. Dorsal sensilla *t*-1 claviform, BS = 0.77; *t*-2 thin and apically pointed; *t*-3 leaf-like. Exterior sensilla *a* long, surpassing the bases of *c* and *d*; *b* short, nearly reaching the base of γ 3; *c* closer to *d* than to *b*, the apex of *c* almost reaching *e*, the apex of *d* surpassing the base of *f*; *f* distinctly nearer to *e* than

to *g*, *e* not reaching tarsus, and *f* nearly reaching tarsus; *g* short, the apex of *g* reaching tarsus. Interior sensilla *a'* broad and proximal to *t*-1; *b'* thin, surpassing the base of *c'*; *c'* thin and its apex surpassing tarsus. Ventral seta β 1 and interior seta δ 4 both short and sensilla-like, β 1 subequal to δ 4. Interior setae δ 1, δ 2, δ 3 and δ 5 each short, but longer than δ 4, and apically pointed. Pores present between *a* and α 3, and between *t*-3 and *g*, respectively. Middle tarsus length 43 μm , claw length 12 μm . Hind tarsus length 46 μm , claw length 16 μm .

Body. Chaetotaxy (Table 1 and Figs 26 - 33).



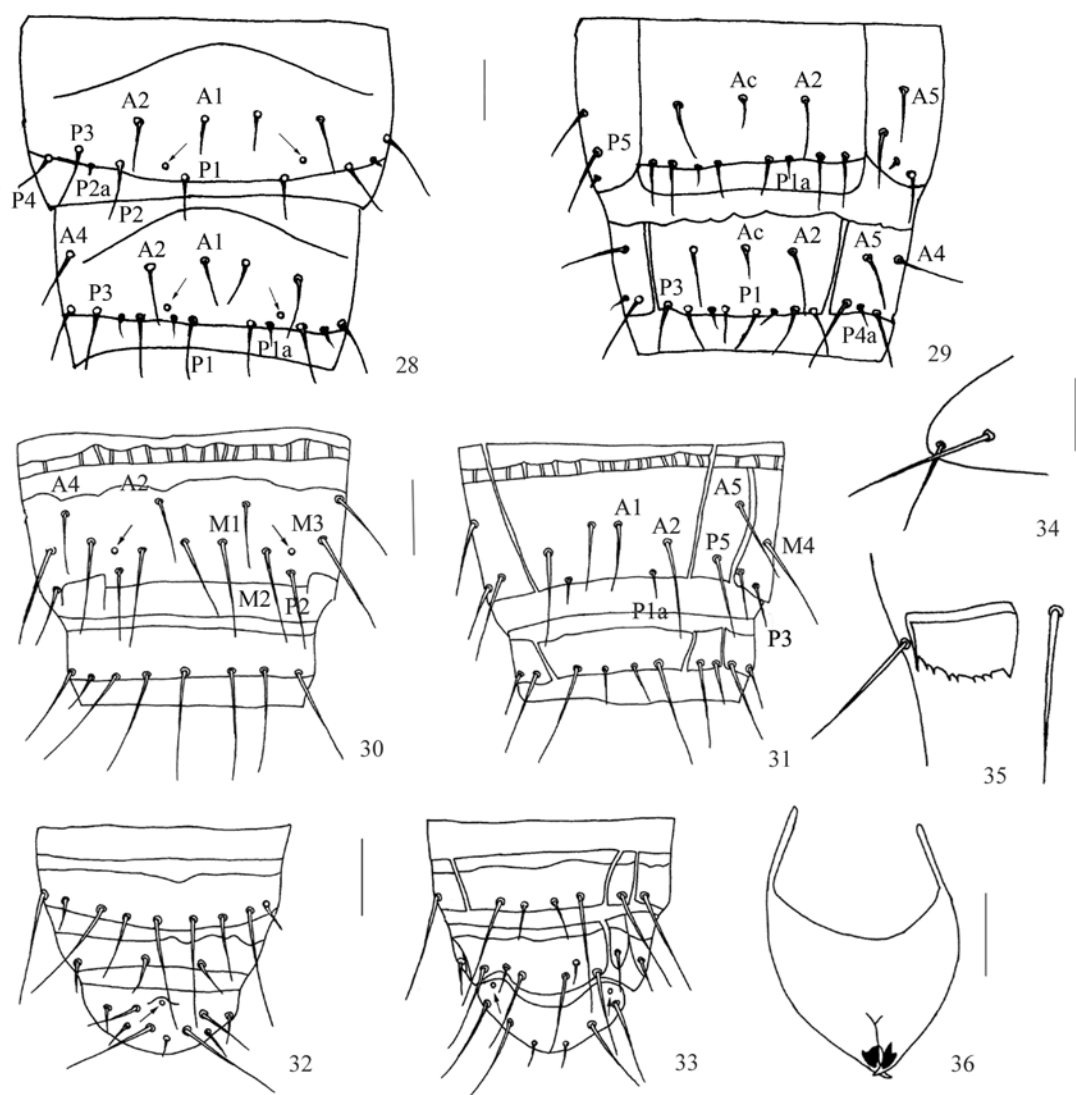
Figs 19 - 27. *Liaoxientulus* sp. 19. Head, dorsal view. 20. Pseudoculus. 21. Canal of maxillary gland. 22. Maxillary palps. 23. Labium. 24. Foretarsus, exterior view. 25. Foretarsus, interior view. 26. Mesonotum. 27. Mesosternum. Arrows indicate pores. Scale bars: 19 = 15 μm , 20 = 6.25 μm , 21 - 22 = 9 μm , 23 = 5 μm , 24 - 25 = 8.75 μm , 26 - 27 = 20 μm .

Thoraces II - III each with two pair of dorsal anterior setae, *A2* and *A4*, seta *P2a* on meso- and metanotum nearer to *P3* than to *P2*. Urotergite I - VI each with three pairs of anterior setae, *A1*, *A2* and *A5*; seta *P1a* absent. Urotergite VII with 8 anterior setae, *A1*, *A2*, *A4* and *A5*; seta *P1a* present. Urotergite IX with 14 setae, X with 12 setae, XI with 6 setae, XII with 9 setae. Urosternites I - VII each with 3 anterior setae, *Ac* and *A2*; VIII with 4 anterior setae and 2 posterior setae; IX - X each with 4 setae; XI - XII each with 6 setae.

Integumental pores distinct (Figs 26 - 33). Thoracic tergite II with two pairs of pores, of which one is posterior to *A4* and the other posterior to *P4*, III with a pair of pores posterior to *P2*. Abdominal

tergites I - VI each with a pair of pores close to *P1*, VII with a pairs of pores close to *P1a*, VIII with a pair of pores between *M2* and *M3* without pectinates. No pores on urosternites I - XI. Telson with a dorsal central pore and a pair of ventral pores at both sides.

Abdominal appendage I with four setae, II and III each with two setae, the lateral apical one longer than a half of the subapical one in length (Fig. 34). Striate band on abdomen VIII present, may be seen more or less distinctly (Figs 30 - 31), comb with about 9 small, irregular teeth (Fig. 35). Female squama genitalis with long pointed acrostyli, and short, thick, stump, strongly sclerotized basal apodemes (Fig. 36), male squama genitalis unknown.



Figs 28 – 36. *Liaoxientulus* sp. 28. Urotergites VI – VII. 29. Urosternites VI – VII. 30. Urotergites VIII – IX. 31. Urosternites VIII – IX. 32. Urotergites X – XII. 33. Urosternites X – XII. 34. Abdominal appendage II. 35. Comb on abdominal tergite VIII. 36. Female squama genitalis. Arrows indicate pores. Scale bars: 28 – 29 = 30 μm , 30 – 31 = 27.5 μm , 32 – 33 = 25 μm , 34 = 9 μm , 35 = 10 μm , 36 = 14 μm .

Younger instars. Unknown.

Distribution. Liaoning Province, Northeastern China.

Remarks. Both *L. sp.* and *L. xingchengensis* are very similar to each other, especially in chaetotaxy. Urotergite VII with 8 anterior setae, *A1*, *A2*, *A4* and *A5*; seta *P1a* present on urotergite VII. They differ in the absence (in *L. sp.*) or presence (in *L. xingchengensis*) of pseudoculus' lids, in the apex position of sensillae *e* and *f* on the foretarsus (in *L. sp.*, *e* not reaching tarsus, *f* nearly reaching tarsus; in *L. xingchengensis*,

e almost reaching tarsus, *f* surpassing tarsus), in the shape of sensilla *a'* on foretarsus (broad in *L. sp.*, thin in *L. xingchengensis*), and in the structure of female squama genitalis. Female squama genitalis in *X. sp.* with long pointed acrostyli and short, thick, stump, strongly sclerotized basal apodemes; in *L. xingchengensis* it only with long pointed acrostyli. We find only one specimen of *L. sp.* in China till now. If more specimens were found in the future, maybe it would be a new species to science.

Table 1. Chaetotaxy of *L. xingchengensis* sp. nov. and *L. sp.*

	Dorsal		Ventral	
	Formula	Composition of setae	Formula	Composition of setae
Thorax				
I	4	1, 2	$\frac{4-4}{6}$	<i>A</i> 1, 1 <i>a</i> , <i>M</i> 1, 1 <i>a</i> , <i>P</i> 1, 2, 3
II – III	$\frac{6}{16}$	<i>A</i> 2, 4, <i>M</i> 1, <i>P</i> 1, 1 <i>a</i> , 2, 2 <i>a</i> , 3, 4, 5, 5 <i>a</i>	$\frac{7-2}{4}$	<i>A</i> c, 1 <i>a</i> , 2, 3, <i>M</i> , <i>P</i> 1, 2
Abdomen				
I	$\frac{6}{10}$	<i>A</i> 1, 2, 5, <i>P</i> 1, 2, 2 <i>a</i> , 3, 4	$\frac{3}{2}$	<i>A</i> c, 2, <i>P</i> 1
II – III	$\frac{6}{14}$	<i>A</i> 1, 2, 5, <i>P</i> 1, 2, 2 <i>a</i> , 3, 4, 4 <i>a</i> , 5	$\frac{3}{5}$	<i>A</i> c, 2, <i>P</i> c, 1 <i>a</i> , 2
IV – VI	$\frac{6}{14}$	<i>A</i> 1, 2, 5, <i>P</i> 1, 2, 2 <i>a</i> , 3, 4, 4 <i>a</i> , 5	$\frac{3}{8}$	<i>A</i> c, 2, <i>P</i> 1, 1 <i>a</i> , 2, 3
VII	$\frac{8}{16}$	<i>A</i> 1, 2, 4, 5, <i>P</i> 1, 1 <i>a</i> , 2, 2 <i>a</i> , 3, 4, 4 <i>a</i> , 5	$\frac{3}{8}$	<i>A</i> c, 2, <i>P</i> 1, 1 <i>a</i> , 2, 3
VIII	$\frac{6}{16}$	<i>A</i> 2, 4, 5, <i>M</i> 1, 2, 3, 4, <i>P</i> 2, 3, 4, 5	$\frac{4}{2}$	<i>A</i> 1, 2, <i>P</i> 1 <i>a</i>
IX	14	1, 2, 3, 3 <i>a</i> , 4, 4 <i>a</i> , 5	4	1 <i>a</i> , 2
X	12	1, 2, 3, 3 <i>a</i> , 4, 5	4	1 <i>a</i> , 2
XI	6	1, 4, 5	6	1, 1 <i>a</i> , 2
XII	9		6	1 <i>a</i> , 2, 3

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and *Najitentulus silvestris* sp. nov. (Protura: Acerentomidae) from the Western Europe. *Ann. Soc. Entomol. Fr.*, 33 (1): 19 – 27.
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中国东北原尾虫一新属一新种 (原尾纲, 蛭科)

吴东辉^{1,2} 尹文英³

1. 中国科学院东北地理与农业生态研究所 长春 130012, E-mail: wudhyang@yahoo.com.cn
2. 吉林大学地球科学学院 长春 130012
3. 中国科学院上海生命研究院植物生理生态研究所 上海 200032

摘要 报道了采自我国东北地区辽宁省兴城市原尾虫 1 新属 1 新种 *Liaoxientulus gen. nov.* 及新种 兴城 辽宁 蛭 *Liaoxientulus xingchengensis* sp. nov. 和该属的 1 个未定名种 *Liaoxientulus sp.*, 新属属于蛭科屠蛭亚科。新属与采自东北黑龙江省的屠蛭亚科伊春蛭属 *Yichumentulus* Yin, 1980 形态最为相近, 其与后者主要差别在于下唇须和前跗内侧感觉器 *b'* 不同, 伊春蛭属下唇须有 1 根膨大的感觉器和 4 根刚毛, 前跗

关键词 原尾纲, 蛭科, 辽西蛭属, 新属, 新种, 中国东北。

中图分类号 Q969.111

内侧感觉器 *b'* 缺如; 新属下唇须退化, 其上感觉器缺如, 刚毛只有 3 根, 但是前跗内侧感觉器 *b'* 存在。新属现有 2 个种, 均为此次新发现, 其中 1 个种为新种 *Liaoxientulus xingchengensis* sp. nov., 另外 1 个种为未定名种 *Liaoxientulus sp.*。新种正模 1 只和副模 1 只以及该属另 1 未定名种标本保存在中国科学院东北地理与农业生态研究所, 新种另 2 只副模保存在上海植物生理生态所昆虫博物馆。